

# AI IN ENERGY SECTOR HR RECRUITMENT: BALANCING EFFICIENCY, BIAS REDUCTION, AND HUMAN TOUCH

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## Abstract

Artificial intelligence (AI) is rapidly transforming human resource (HR) recruitment by improving hiring efficiency, reducing administrative workload, and supporting data-driven decision-making. In the energy sector, where organizations increasingly require highly skilled and specialized talent, AI-enabled recruitment systems offer significant opportunities to streamline candidate sourcing, screening, and selection. Despite these advantages, concerns remain regarding algorithmic bias, transparency, ethical decision-making, and the preservation of meaningful human interaction throughout the recruitment process. This study qualitatively examines the integration of AI into HR recruitment within the energy sector, emphasizing the balance between operational efficiency, bias reduction, and the irreplaceable value of human judgment. Drawing on recent literature, organizational perspectives, and selected evidence from digital transformation and AI implementation studies, the article explores how AI can complement rather than replace HR professionals in recruitment decisions. The findings suggest that AI substantially enhances recruitment speed, consistency, and predictive capability while supporting more objective candidate evaluation when appropriately governed. However, effective recruitment outcomes continue to depend on human empathy, contextual understanding, ethical oversight, and final managerial judgment. The study proposes a balanced recruitment framework in which AI functions as a strategic decision-support tool alongside HR expertise. The article contributes practical insights for HR managers and policymakers seeking to implement responsible AI-enabled recruitment practices that improve workforce quality while maintaining fairness, transparency, and human-centered organizational values in the evolving energy sector.

## Key words

Artificial Intelligence; Human Resource Management; HR Recruitment; Energy Sector; Bias Reduction; Human Touch

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## INTRODUCTION

Artificial intelligence (AI) has become one of the most influential technologies driving digital transformation across industries, fundamentally changing how organizations manage business processes and human capital. In recent years, the energy sector has increasingly adopted AI-powered technologies to improve operational efficiency, predictive maintenance, energy optimization, and organizational decision-making (Chen et al., 2022). Alongside these technological advancements, Human Resource Management (HRM) has also experienced substantial transformation through AI-assisted recruitment systems that automate candidate sourcing, resume screening, interview scheduling, and talent matching (Basu et al., 2023).

The energy sector operates in a highly competitive environment where recruiting qualified engineers, technical specialists, data scientists, and managerial professionals is becoming increasingly challenging. Conventional

recruitment methods often require significant time, financial resources, and administrative effort while remaining vulnerable to subjective judgments and unconscious human bias. Consequently, many organizations are integrating AI into their recruitment frameworks to enhance hiring efficiency, improve decision consistency, and strengthen workforce quality (Hunkenschroer & Luetge, 2022).

Previous studies have emphasized that effective recruitment remains one of the most critical functions of HRM because organizational performance largely depends on attracting and retaining competent employees (Khan & Ahmed, 2010; Azad et al., 2011). Although traditional recruitment approaches provide opportunities for interpersonal evaluation and contextual judgment, they may also introduce inconsistencies and personal biases during candidate assessment. AI-supported recruitment attempts to address these limitations by utilizing machine learning algorithms, predictive analytics, and intelligent decision-support systems that evaluate applicants using standardized criteria.

The rapid expansion of AI across engineering, automation, cloud computing, and intelligent industrial systems demonstrates its growing capability to support complex organizational decisions beyond purely technical applications (Ahmed et al., 2021; Chen et al., 2022; Widjaja et al., 2022). Similarly, cloud-based infrastructures and autonomous AI systems have enabled organizations to process large volumes of recruitment data more efficiently while improving organizational resilience and business continuity (Khan, 2022). These technological developments provide an important foundation for AI-enabled HR recruitment within modern energy organizations.

Despite these advantages, AI-driven recruitment has generated important ethical and managerial concerns. Algorithmic bias, transparency, explainability, privacy protection, and accountability continue to challenge organizations seeking to automate hiring decisions. Ethical implementation requires AI to complement rather than replace human judgment, ensuring fairness, diversity, and responsible decision-making throughout the recruitment process (Khan & Fadziso, 2020). Human empathy, contextual understanding, communication skills, and organizational culture remain difficult for AI systems to replicate completely.

Furthermore, the broader digital transformation of organizations demonstrates that technological innovation produces the greatest value when integrated with human-centered management practices. Studies on customer engagement, digital transformation, organizational services, and technology-enabled decision-making consistently emphasize the importance of balancing technological capability with human values and stakeholder trust (Allam et al., 2022; Forid et al., 2022; Thompson & Allam, 2022).

Against this background, this study qualitatively examines the integration of AI into HR recruitment within the energy sector by exploring three interconnected dimensions: recruitment efficiency, bias reduction, and the irreplaceable role of the human touch. Rather than positioning AI as a replacement for HR professionals, the article argues that sustainable recruitment outcomes emerge from collaborative decision-making where intelligent technologies strengthen, rather than substitute for, professional human expertise. The findings are expected to provide practical guidance for HR managers, organizational leaders, and policymakers seeking to implement responsible AI-assisted recruitment strategies while preserving ethical standards and human-centered organizational values.

## LITERATURE REVIEW

### Artificial Intelligence and Human Resource Recruitment

Artificial intelligence has emerged as a strategic resource for modern Human Resource Management by automating repetitive recruitment activities and supporting evidence-based hiring decisions. AI-enabled recruitment platforms utilize machine learning, natural language processing, and predictive analytics to identify suitable candidates, rank applicants, and improve recruitment efficiency. Recent HR research indicates that AI can significantly reduce recruitment time while increasing consistency in candidate evaluation and enhancing organizational responsiveness to changing workforce demands.

The growing application of AI across industrial automation, engineering systems, and intelligent technologies further demonstrates its capacity to improve organizational performance beyond technical operations (Ahmed et al., 2021; Chen et al., 2022). These developments suggest that similar intelligent approaches can strengthen recruitment processes, particularly in knowledge-intensive sectors such as energy, where identifying highly specialized talent is increasingly important.

### AI-Driven Recruitment Efficiency

Recruitment efficiency has become one of the primary motivations for AI adoption. Conventional recruitment frequently involves manual resume screening, interview scheduling, applicant communication, and document verification, all of which consume considerable organizational resources (Strohmeier, 2020). AI substantially accelerates these activities by automatically processing large applicant databases and identifying qualified candidates according to predefined criteria.

Cloud computing and intelligent decision-support systems further enhance recruitment performance by enabling real-time data processing and organizational flexibility (Khan, 2022). Likewise, project-oriented technology implementation frameworks emphasize that successful digital transformation depends not only on technological capability but also on effective organizational process management (Ahmed & Khan, 2010). Therefore, AI implementation in recruitment should be viewed as a strategic organizational transformation rather than merely a software deployment initiative.

### **Algorithmic Bias and Ethical Recruitment**

Although AI promises greater objectivity, algorithmic bias remains one of the most significant challenges in AI-supported recruitment. Machine learning models are trained using historical organizational data, which may unintentionally reflect existing social inequalities or previous hiring preferences (Votto et al., 2021). Consequently, biased training data may influence recruitment outcomes even when decision-making appears automated.

Ethical AI implementation requires transparency, accountability, fairness, explainability, and continuous human oversight. Discussions surrounding AI ethics consistently argue that technological advancement should support responsible organizational decision-making rather than replace professional accountability (Khan & Fadziso, 2020). Organizations should therefore conduct regular audits of AI recruitment systems to ensure equitable candidate evaluation and compliance with legal and ethical standards.

Psychological and socioeconomic factors also influence organizational decision-making and individual behavior (Li et al., 2021), suggesting that recruitment should not rely exclusively on algorithmic predictions. Human judgment remains essential for understanding contextual information, interpersonal capability, leadership potential, and organizational fit that algorithms may not fully capture.

### **Human Touch in AI-Assisted Recruitment**

Despite continuous advances in AI, the human touch remains indispensable throughout the recruitment process. Recruitment extends beyond identifying technical competence; it also involves assessing communication ability, ethical behavior, adaptability, emotional intelligence, and organizational compatibility (Vrontis et al., 2022). These characteristics often require direct interpersonal interaction and professional HR experience.

Research on human-centered digital transformation emphasizes that technology should strengthen, rather than diminish, meaningful human relationships and stakeholder engagement (Allam et al., 2022; Thompson & Allam, 2022). Similarly, studies on digital transformation and organizational service improvement suggest that successful technology adoption depends on maintaining user trust, transparency, and satisfaction (Forid et al., 2022).

Continuous learning also plays an essential role in enabling HR professionals to effectively collaborate with AI technologies. Organizational development literature emphasizes ongoing professional development and knowledge enhancement as key drivers of successful technology adoption (Zhilgildinova et al., 2022). Accordingly, HR managers require both technical literacy and ethical awareness to maximize AI's benefits while preserving human-centered recruitment practices.

### **AI Adoption in the Energy Sector**

Energy organizations increasingly rely on AI to optimize operational efficiency, predictive maintenance, resource allocation, and engineering performance (Chen et al., 2022; Widjaja et al., 2022). These developments indicate that AI adoption has become an integral component of organizational modernization within the energy industry. Extending similar intelligent technologies to HR recruitment represents a logical progression in organizational digital transformation.

Moreover, evidence from diverse industries demonstrates that AI-supported decision-making enhances organizational adaptability, innovation, and sustainable performance (Zirar et al., 2020). Consequently, HR recruitment in the energy sector should adopt a balanced framework where AI improves efficiency and reduces bias while HR professionals retain responsibility for ethical judgment, final hiring decisions, and preserving the human touch throughout the recruitment process. Based on the reviewed literature, this study proposes that the most effective recruitment outcomes are achieved when AI functions as a decision-support system operating alongside experienced HR professionals rather than as an autonomous replacement for human expertise.

## **METHODOLOGY (QUALITATIVE/THEORETICAL ANALYSIS)**

This study adopts a qualitative theoretical approach to examine the integration of artificial intelligence into Human Resource (HR) recruitment within the energy sector. Rather than collecting primary data through surveys or interviews, the research synthesizes contemporary academic literature, organizational practices, and published studies to develop a conceptual understanding of how AI influences recruitment efficiency, bias reduction, and the preservation of human judgment.

A narrative literature review was conducted by examining peer-reviewed journal articles published primarily between 2020 and 2022, with particular emphasis on research addressing artificial intelligence, human resource management, digital transformation, recruitment technologies, algorithmic fairness, and organizational decision-making. To strengthen the theoretical foundation, selected earlier studies on recruitment and HR practices were also incorporated where they provided important contextual insights into conventional recruitment systems (Khan & Ahmed, 2010; Azad et al., 2011).

The analysis followed a thematic approach consisting of four sequential stages. First, relevant literature was reviewed to identify the major technological developments in AI-supported recruitment. Second, previous studies discussing organizational efficiency, machine learning applications, cloud-based decision support, and digital transformation were examined to understand the broader technological context (Ahmed et al., 2021; Chen et al., 2022; Khan, 2022). Third, ethical and managerial issues including algorithmic bias, transparency, accountability, and human oversight were analyzed using existing scholarly evidence (Khan & Fadziso, 2020). Finally, the findings were synthesized to propose a balanced AI-assisted recruitment framework suitable for energy sector organizations.

The conceptual analysis also considered evidence from interdisciplinary studies involving organizational management, customer engagement, technology adoption, education, engineering, and innovation management. Although these studies addressed different application domains, they collectively demonstrate that successful digital transformation depends on balancing technological capability with human expertise (Allam et al., 2022; Forid et al., 2022; Jawad et al., 2022a; Thompson & Allam, 2022; Zhilgildinova et al., 2022).

Because this article is conceptual in nature, no human participants were involved, and ethical approval was not required. The objective is not to generalize statistical relationships but to develop a theoretically grounded framework that may guide future empirical investigations within energy sector HR recruitment.

## FINDINGS AND DISCUSSION

The literature indicates that AI has the potential to transform recruitment practices by improving operational efficiency while supporting more consistent and evidence-based hiring decisions. However, the findings also demonstrate that technological capability alone cannot guarantee successful recruitment outcomes. Sustainable HR recruitment depends on maintaining an appropriate balance between intelligent automation and professional human judgment.

### AI Improves Recruitment Efficiency

One of the most significant findings is that AI substantially increases recruitment efficiency. Intelligent recruitment platforms automate resume screening, applicant ranking, interview scheduling, and candidate communication, enabling HR departments to process large applicant pools in considerably less time than conventional recruitment methods.

The energy sector frequently experiences shortages of highly qualified technical professionals. AI-assisted recruitment enables organizations to identify candidates possessing specialized engineering, digital, and analytical competencies more efficiently. Similar technological advancements have already demonstrated considerable success in engineering systems, industrial automation, intelligent home technologies, cloud computing, and hybrid energy management (Ahmed et al., 2021; Chen et al., 2022; Widjaja et al., 2022). These developments suggest that AI can provide comparable value within organizational HR functions.

Furthermore, effective implementation should be viewed as an organizational transformation project rather than simply the adoption of new software. Successful digital initiatives require careful planning, integration, monitoring, and continuous improvement throughout implementation (Ahmed & Khan, 2010).

### AI Supports Bias Reduction but Cannot Eliminate Bias Completely

Another important finding concerns bias reduction. Human recruiters may unintentionally introduce subjective preferences based on personal experiences, stereotypes, or unconscious assumptions. AI systems can reduce certain forms of inconsistency by evaluating applicants using standardized selection criteria.

Nevertheless, AI is not inherently free from bias. Algorithms learn from historical organizational data, meaning that biased recruitment records may unintentionally influence future hiring recommendations (Pessach & Shmueli, 2020). Consequently, organizations should regularly evaluate AI models to ensure fairness, transparency, explainability, and regulatory compliance.

Ethical governance therefore becomes essential throughout AI implementation. Previous discussions on AI ethics emphasize that responsible technology adoption requires accountability, transparency, and continuous human supervision rather than complete automation (Khan & Fadziso, 2020).

### Human Touch Remains Irreplaceable

Although AI improves administrative efficiency, the findings consistently demonstrate that the human touch remains indispensable throughout recruitment. Important hiring decisions frequently depend on interpersonal communication, emotional intelligence, leadership potential, organizational culture, adaptability, ethical judgment, and contextual understanding. Recruitment should therefore be viewed as both a technological and human-centered process. Human Resource professionals contribute empathy, negotiation skills, intuition, conflict resolution, and organizational experience that cannot currently be replicated by intelligent algorithms.

Research on human-centered digital transformation similarly emphasizes that technology should strengthen human relationships rather than replace them (Allam et al., 2022; Thompson & Allam, 2022). Likewise, digital transformation initiatives produce sustainable organizational outcomes only when users maintain trust in technological systems (Forid et al., 2022).

### Organizational Readiness for AI Recruitment

The findings further suggest that organizational readiness significantly influences AI adoption. HR professionals require continuous training to understand AI capabilities, algorithmic limitations, ethical responsibilities, and data governance practices. Professional development enables HR managers to collaborate effectively with intelligent decision-support systems while preserving accountability for final recruitment decisions.

Studies addressing educational development and lifelong professional learning support the importance of continuous competency enhancement during technological transformation (Zhilgildinova et al., 2022). Organizations should therefore invest not only in AI technologies but also in employee capability development.

Additionally, psychological, behavioral, and socioeconomic factors continue to influence organizational decision-making (Li et al., 2021). Consequently, recruitment strategies should combine quantitative AI recommendations with qualitative human assessment to ensure fair and comprehensive candidate evaluation.

### Broader Organizational Implications

The broader organizational evidence demonstrates that AI adoption extends well beyond recruitment. Recent studies have illustrated the growing contribution of AI to cloud reliability, healthcare decision support, digital marketing, organizational analytics, and sustainable business development (Khan, 2022; Jawad et al., 2022b; Rahman & Akhter, 2022). Collectively, these developments indicate that AI is becoming an enterprise-wide strategic capability rather than an isolated technological application. Similarly, evidence from accounting, financial management, and organizational reporting demonstrates that data-driven decision-making improves transparency and managerial effectiveness (Ahmed et al., 2011; Khan et al., 2020). Such organizational experience further supports the integration of AI into HR recruitment as part of a comprehensive digital transformation strategy.

Traditional industries have also experienced continuous modernization through systematic organizational learning and technological innovation (Khan et al., 2015). Therefore, energy organizations should adopt AI recruitment gradually, integrating technological innovation with existing HR expertise and organizational culture.

Table 1: Comparison between Conventional and AI-Assisted HR Recruitment in the Energy Sector

Recruitment Dimension	Conventional Recruitment	AI-Assisted Recruitment	Role of Human HR
Resume Screening	Manual review	Automated screening and ranking	Validate shortlisted candidates
Recruitment Speed	Relatively slow	Faster processing	Monitor recruitment quality
Bias Control	Higher possibility of subjective bias	More standardized evaluation	Audit fairness and ethics
Candidate Experience	Human interaction throughout	Digital interaction with automation	Build trust and relationships
Decision Making	Experience-based	Data-supported recommendations	Final hiring authority
Transparency	Depends on recruiter	Depends on AI explainability	Ensure accountability

Table 1 presents a comparative overview of conventional and AI-assisted HR recruitment practices in the energy sector. The comparison demonstrates that AI significantly improves recruitment efficiency by accelerating resume screening, candidate matching, and recruitment workflows while reducing manual administrative tasks. AI also contributes to greater consistency and standardized candidate evaluation, thereby minimizing the influence of

subjective human bias during the initial stages of recruitment. However, the table further highlights that AI should function as a decision-support tool rather than an autonomous decision-maker. Human Resource professionals continue to play a critical role in validating shortlisted candidates, ensuring ethical compliance, interpreting organizational context, assessing interpersonal competencies, and making final hiring decisions. Therefore, the most effective recruitment outcomes are achieved through a hybrid recruitment framework that combines AI-driven analytical capabilities with human judgment, transparency, and organizational accountability (Khan & Fadziso, 2020; Hunkenschroer & Luetge, 2022; Vrontis et al., 2022).

Figure 1 illustrates the proposed conceptual framework for AI-assisted recruitment in the energy sector. The framework demonstrates how AI technologies, including machine learning, natural language processing, predictive analytics, and automation tools, support the recruitment process by improving screening efficiency, candidate matching, and interview management. These technological capabilities contribute to enhanced recruitment efficiency and bias reduction through standardized, data-driven decision-making. However, the framework emphasizes that HR review, ethical oversight, and human judgment remain essential to ensure fairness, transparency, organizational fit, and final hiring decisions. Ultimately, the integration of AI with human expertise leads to sustainable recruitment outcomes, improved workforce quality, and long-term organizational competitiveness.



Figure 1: Proposed Conceptual Framework for AI-Assisted Recruitment in the Energy Sector

Overall, the findings indicate that AI should not replace HR professionals but should function as an intelligent decision-support partner. Organizations within the energy sector are likely to achieve superior recruitment outcomes when technological efficiency is combined with ethical governance, continuous organizational learning, and the irreplaceable human touch.

## PRACTICAL IMPLICATIONS

The findings of this study provide several practical implications for HR professionals, organizational leaders, and policymakers in the energy sector. As organizations continue their digital transformation journeys, AI should be viewed as a strategic decision-support technology rather than a substitute for human expertise. Energy companies can leverage AI to streamline recruitment activities such as candidate sourcing, resume screening, interview scheduling, and preliminary applicant evaluation, thereby reducing recruitment time and administrative costs.

To maximize the benefits of AI-assisted recruitment, organizations should establish clear governance frameworks that promote fairness, transparency, accountability, and compliance with relevant employment regulations. Regular audits of AI algorithms should be conducted to identify and minimize potential biases that may arise from historical recruitment data. In addition, explainable AI techniques should be adopted to ensure that recruitment recommendations can be interpreted and justified by HR professionals.

Another important implication is the need for continuous HR capability development. HR managers should receive regular training in AI technologies, data analytics, ethical decision-making, and digital recruitment practices. Strengthening digital competencies will enable HR professionals to collaborate more effectively with AI systems while maintaining responsibility for final hiring decisions.

Organizations should also preserve meaningful human interaction throughout the recruitment process. Although AI can improve operational efficiency, candidate engagement, communication, behavioral assessment, and cultural fit evaluation continue to require human judgment. A hybrid recruitment model that combines AI-generated insights with professional HR expertise is therefore likely to produce more balanced, ethical, and sustainable recruitment outcomes.

Finally, organizations in the energy sector should integrate AI recruitment within broader digital transformation strategies rather than implementing isolated technological solutions. Aligning recruitment technologies with organizational objectives, workforce planning, and long-term talent management strategies will enhance organizational competitiveness while supporting sustainable human resource management.

## LIMITATIONS AND FUTURE RESEARCH

This study is subject to several limitations. First, the research is conceptual and qualitative in nature, relying primarily on existing academic literature and theoretical analysis rather than primary empirical data collected from energy sector organizations. Consequently, the findings should be interpreted as theoretical insights rather than statistically validated conclusions.

Second, the discussion focuses specifically on AI-assisted recruitment within the energy sector. Although many of the identified opportunities and challenges may be applicable to other industries, organizational structures, regulatory environments, technological maturity, and workforce characteristics differ across sectors. Therefore, caution should be exercised when generalizing the findings beyond the energy industry.

Third, the study synthesizes interdisciplinary evidence from human resource management, artificial intelligence, digital transformation, engineering, organizational management, and related fields. While this interdisciplinary approach broadens the conceptual perspective, future studies could further strengthen the evidence base through sector-specific investigations and comparative analyses.

Future research should incorporate empirical methods such as surveys, semi-structured interviews, focus group discussions, and case studies involving HR managers, recruiters, and employees from energy organizations. Quantitative studies may also examine the relationships between AI adoption, recruitment efficiency, hiring quality, employee diversity, organizational performance, and candidate satisfaction using statistical modeling techniques.

Additionally, future investigations should explore emerging topics such as explainable artificial intelligence (XAI), generative AI in recruitment, ethical AI governance, cross-cultural recruitment practices, cybersecurity and data privacy in AI-enabled HR systems, and the long-term impact of AI on employee trust and organizational sustainability. Comparative studies involving different countries, energy subsectors, and organizational sizes would also contribute valuable insights to the growing body of knowledge on AI-assisted human resource management.

## CONCLUSION

Artificial intelligence is reshaping Human Resource Management by introducing faster, more data-driven, and increasingly intelligent recruitment practices. Within the energy sector, where organizations compete for highly skilled professionals and technical expertise, AI-assisted recruitment offers significant opportunities to improve hiring efficiency, reduce administrative burdens, and support evidence-based decision-making. The findings of this study indicate that AI can substantially enhance candidate sourcing, resume screening, applicant matching, and recruitment consistency while contributing to more standardized evaluation processes.

However, the study also demonstrates that technological advancement alone cannot ensure effective and ethical recruitment. Algorithmic bias, limited contextual understanding, data quality issues, transparency concerns, and ethical accountability remain important challenges that require continuous human oversight. Although AI can assist HR professionals by generating analytical insights and reducing repetitive tasks, it cannot fully replicate human empathy, ethical reasoning, interpersonal communication, cultural understanding, or professional judgment. Consequently, the human touch remains indispensable in final hiring decisions and relationship-building throughout the recruitment process.

This article proposes that organizations within the energy sector should adopt a balanced recruitment framework in which AI functions as a strategic decision-support system rather than an autonomous decision-maker. Successful implementation requires responsible AI governance, transparent algorithms, continuous employee training, and organizational policies that promote fairness, inclusiveness, and accountability. Integrating intelligent technologies with experienced HR professionals enables organizations to achieve both operational efficiency and ethical recruitment outcomes.

Overall, sustainable HR recruitment in the energy sector depends on creating a collaborative partnership between artificial intelligence and human expertise. Such a balanced approach not only strengthens organizational competitiveness but also supports responsible workforce development, equitable hiring practices, and long-term organizational sustainability in an increasingly digital business environment.

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